

WHAT IS CLAIMED IS:

1. A displacement detecting apparatus comprising:
  - an illumination system which applies a divergent light beam from a light-emitting device to the reflection scale provided on a measurement object which relatively moves;
  - said reflection scale which guides the light beam applied by said illumination system to a direction different from said illumination system by at least two reflections; and
  - a light sensing device which detects an amount of a light beam reflected by said reflection scale.
- 15 2. An apparatus according to claim 1, wherein said reflection scale has an optical function of wavefront-splitting the divergent light beam from said illumination system into a plurality of light beams and overlaying the plurality of wavefront-split light beams at a predetermined position.
- 25 3. An apparatus according to claim 1, wherein said reflection scale has an optical function of wavefront-splitting the divergent light beam from said illumination system into a plurality of light beams and overlaying the plurality of wavefront-split light beams on a detection surface of said light

sensing device.

4. An apparatus according to claim 1, wherein  
said reflection scale is a roof type reflection  
5 element formed by opposing two reflection surfaces at  
a predetermined angle.

5. An apparatus according to claim 4, wherein  
said reflection scale has a plurality of roof type  
10 reflection elements, each identical to said roof type  
reflection element, arrayed in a predetermined  
direction.

6. An apparatus according to claim 5, wherein  
15 said reflection scale having said plurality of roof  
type reflection elements, each identical to said roof  
type reflection element, arrayed in the predetermined  
direction is formed by a metal reflection surface,  
and a reflection area thereof is a surface reflection  
20 type mirror.

7. An apparatus according to claim 5, wherein  
said reflection scale having said plurality of roof  
type reflection elements, each identical to said roof  
25 type reflection element, arrayed in the predetermined  
direction is formed by a metal reflection surface,  
and a reflection area thereof is a surface reflection.

8. An apparatus according to claim 7, wherein  
said reflection scale having said plurality of roof  
type reflection elements, each identical to said roof  
type reflection element, arrayed in the predetermined  
5 direction is an internal reflection type mirror made  
of a transparent material, and has cylindrical  
surfaces on the light beam incident and exit surface  
sides.

10 9. An apparatus according to claim 5, wherein  
said reflection scale having said plurality of roof  
type reflection elements, each identical to said roof  
type reflection element, arrayed in the predetermined  
direction is formed such that all angles defined by  
15 reflection surfaces are equal to each other.

10. An apparatus according to claim 5, wherein  
said reflection scale having said plurality of roof  
type reflection elements, each identical to said roof  
type reflection element, arrayed in the predetermined  
20 direction is formed such that angles defined by  
reflection surfaces continuously increase/decrease  
from a central portion to a peripheral portion in an  
array direction of said roof type reflection elements  
25 in said reflection scale.

11. An apparatus according to claim 5, wherein

said reflection scale has a plurality of roof type reflection elements, each identical to said roof type reflection element, discontinuously arrayed in a moving direction.

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12. An apparatus according to claim 11, wherein said reflection scale has a plurality of roof type reflection elements, each identical to said roof type reflection element, discontinuously arrayed in a  
10 moving direction, and a discontinuous portion has a substantially nonreflection characteristic.

13. An apparatus according to claim 4, wherein said reflection scale is formed such that a ridge  
15 formed by joining surfaces of said roof type reflection elements forms part of an arc or ellipse.

14. An apparatus according to claim 13, wherein said reflection scale having said plurality of roof  
20 type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is formed by a metal reflection surface, and a reflection area thereof is a surface reflection type mirror.

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15. An apparatus according to claim 13, wherein said reflection scale having said plurality of roof

type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is formed by a metal reflection surface, and a reflection area thereof is a rear surface  
5 reflection type mirror.

16. An apparatus according to claim 15, wherein  
said reflection scale having said plurality of roof  
type reflection elements, each identical to said roof  
10 type reflection element, arrayed in the predetermined  
direction is an internal reflection type mirror made  
of a transparent material, and has cylindrical  
surfaces on the light beam incident and exit surface  
sides.

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17. An apparatus according to claim 13, wherein  
said reflection scale having said plurality of roof  
type reflection elements, each identical to said roof  
type reflection element, arrayed in the predetermined  
20 direction is formed such that all angles defined by  
reflection surfaces are equal to each other.

18. An apparatus according to claim 13, wherein  
said reflection scale having said plurality of roof  
25 type reflection elements, each identical to said roof  
type reflection element, arrayed in the predetermined  
direction is formed such that angles defined by

reflection surfaces continuously increase/decrease from a central portion to a peripheral portion in an array direction of said roof type reflection elements in said reflection scale.

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19. An apparatus according to claim 13, wherein said reflection scale has a plurality of roof type reflection elements, each identical to said roof type reflection element, discontinuously arrayed in a moving direction.

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20. An apparatus according to claim 19, wherein said reflection scale has a plurality of roof type reflection elements, each identical to said roof type reflection element, discontinuously arrayed in a moving direction, and a discontinuous portion has a substantially nonreflection characteristic.

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21. An apparatus according to claim 4, wherein said reflection scale is formed such that an envelope surface formed by ridges formed by joining surfaces of said roof type reflection elements forms part of a spherical surface.

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22. An apparatus according to claim 21, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof

type reflection element, arrayed in the predetermined direction is formed by a metal reflection surface, and a reflection area thereof is a surface reflection type mirror.

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23. An apparatus according to claim 21, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is formed by a metal reflection surface, and a reflection area thereof is a surface reflection.

15 24. An apparatus according to claim 21, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is an internal reflection type mirror made of a transparent material, and has cylindrical surfaces on the light beam incident and exit surface 20 sides.

25 25. An apparatus according to claim 21, wherein said reflection scale having said plurality of roof type reflection elements, each identical to said roof type reflection element, arrayed in the predetermined direction is formed such that all angles defined by reflection surfaces are equal to each other.

26. An apparatus according to claim 25, wherein  
said reflection scale having said plurality of roof  
type reflection elements, each identical to said roof  
type reflection element, arrayed in the predetermined  
5 direction is formed such that angles defined by  
reflection surfaces continuously increase/decrease  
from a central portion to a peripheral portion in an  
array direction of said roof type reflection elements  
in said reflection scale.

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27. An apparatus according to claim 21, wherein  
said reflection scale has a plurality of roof type  
reflection elements, each identical to said roof type  
reflection element, discontinuously arrayed in a  
15 moving direction.

28. An apparatus according to claim 27, wherein  
said reflection scale has a plurality of roof type  
reflection elements, each identical to said roof type  
20 reflection element, discontinuously arrayed in a  
moving direction, and a discontinuous portion has a  
substantially nonreflection characteristic.